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BIOLOGICAL SUGGESTIONS.

ASSIMILATIVE COLOURATION.

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Part I.

Mr. Darwin admits that there are unknown laws of development and variation, and certain direct actions of external conditions, which to some extent modify animal forms; but, so far as yet known, these can only be permanently preserved or increased, when useful, by means of natural selection. We are not now discussing whether this view is strictly correct, or whether there are not probably unknown laws determining the lines of directions in which alone natural selection can profitably and permanently act. There may be such, and the present writer is disposed to think there are such; but these have not been proved to exist.—A. R. Wallace.

We are not enunciating ascertained truths; we are simply recording the results of study.—G. H. Lewes.

Any student of natural history who cares to analyse the vast strides made by his science during the last thirty years must be impressed by the great advance which has taken place in the philosophical conception of the origin of animal colouration. "Protective resemblance," "mimicry," and "utility markings" are now by-words with every naturalist, whilst some scientific theory has replaced much teleological wonder. Although our new views are in very many cases explanations of old observations, these views have in friends and foes alike created such a host of good observers, who are anxious to support or demolish advanced

theories, that purely zoological suppositions are often the forerunners of original experiment and the discharge of a battery of new or little-known facts. In this way the opponents of evolution have been of the greatest service to the cause. They have acted as deterrents to too hasty generalizations; by their contentions a greater precision in the argument has been attained; while the facts adduced as weapons in their controversy have not only often proved new, but actually supportive of the cause attacked, and have not infrequently become honoured inmates of the evolutionary armoury.

Much biological controversy is only of a more or less forensic character. It has often occurred to the writer that considerable interest would attach to biological briefs being drawn up by different theorists, and the same handed to eminent Queen's Counsel to be made much, or little of, as ingenious argument could bolster up or destroy. Dean Buckland, as related by his son, once placed the evidence for the former existence of hyænas in England before "one of the most learned judges in the land," with the further argument of their equally rapacious and ravenous character. And now, said the Dean, "what do you think of that, my lord?" Such facts, replied the Judge, "brought as evidence against a *man*, would be sufficient to convict and even hang him."* Judicial consideration would be most beneficial in many biological theories, where the facts are strong but the argument weak, or, as is not altogether unusual, the strength of the advocacy is in an inverse ratio to that of the evidence. There is also a danger, now that we have entered so many of nature's portals, in believing that our present keys will open all locks, and that our explanations of many problems in animal colouration are sufficient for universal application. It seems more probable, however, that we have captured many outworks, and threatened the citadel, but certainly not secured it, and under these circumstances one may offer some suggestions and indulge in some criticism, as at a council of war, without being proclaimed a deserter from evolutionary principles, or an enemy to advanced ideas of natural selection.

How far have we at present accounted for the varied animal colouration which we see around us? the glory of our cabinet-

* 'Curiosities of Nat. Hist.,' Pop. Edit., 2nd ser., p. 53.

drawers, the mysterious wonder in the galleries of our museums, the charm of travellers abroad, and appreciative lovers of nature at home. Very much, when the difficulty of the problem is considered, and especially where the utility of animal disguises and mimicking appearances has been unravelled by the magic wand of "natural selection," or "the survival of the fittest." But very little when we wish to understand the larger element in the phenomena of colour, to which we are, at present, unable to take the initiatory steps of defining its exact purpose in the battle of life. Some colour-development appears to be inscrutable as the green bones in the Mud-fish (*Protopterus annectans*), and the common Gar-fish (*Lepidosteus* sp.). As Darwin remarks, in the Hornbill (*Buceros bicornis*) the inside of the mouth is black in the male and flesh-coloured in the female.* In the twelve-winged Bird of Paradise (*Seleucides nigricans*) the mouth and throat are of a "vivid grass-green colouring," which was seen by Guillemard in the course of feeding, when the bird threw a cockroach in the air and caught it lengthways.† At St. Kilda, Mr. R. Kearton describes how on a small ledge of rock in the mouth of a cave "I observed a little patch of brilliant orange colour appearing and disappearing simultaneously with the sound," which that writer was endeavouring to unravel: "it was the open mouth of a Black Guillemot."‡ In the Transvaal, the writer was informed by a poultry fancier of Pretoria that his imported White Leghorns lose the yellow colour of their legs; the young chickens exhibit that colour, but again lose it as they grow older. The body cavity of some Lizards is deep black; the pigmentation does not affect the entire lining of the body cavity, but only a part of it which is sharply differentiated from the rest; the palate of the Ourang-outan is black, that of the Chimpanzee flesh-coloured, with no pigment at all.§ In the preparatory stages of Lepidoptera there appears to be, as a rule, no relation either in tint or brilliancy of colour between larva, pupa, and imago.‖ But there are exceptions, as in the case of that well-

* 'Descent of Man,' 2nd edit., p. 426.

† 'Cruise of the Marchesa,' 2nd edit., p. 434.

‡ 'With Nature and a Camera,' p. 61.

§ Beddard, 'Animal Colouration,' 2nd edit., p. 10.

‖ So among Molluscs—"The colour of the shell does not necessarily

known and undesirable garden moth, *Abraxas grossulariata*, in which the larva and pupa are both prominently marked with yellow and black, and the perfect insect exhibits the same prominent hues. Plants often develop colour in response to purely environmental conditions. Mr. Scott Elliot observes:—"I have noticed everywhere that in places .... where there is plenty of sunlight and not enough humidity to form a large amount of branches and leafage, the surplus nourishment is usually disposed of in bright colouring. A curious instance of this effect carried to extremes is an orchid (*Disa erubescens*, Rendle), which is all over the curious red colour which one often sees on the leaves and stems, *e.g.* of our common Herb Robert in England. Other instances of this sort of flora may be seen, *e.g.* on the limestone hillocks about Alexandria and on Table Mountain summit."* Mr. Wallace enumerates as instances of colour needing "no special explanation," those algæ and fungi which have bright colours—the "red-snow" of the Arctic regions, the red, green, or purple seaweeds, the brilliant scarlet, yellow, white, or black agarics, and other fungi; also the varied tints of the bark of trunks, branches, and twigs, which are often of various shades of brown and green, or even vivid reds or yellows.† Prof. Marshall Ward also remarks:—"The red colour often assumed by parts of plants other than flowers, especially young leaves, afforded an instance of the danger of pushing an explanation too far. In many instances it doubtless served to absorb some of the sunlight, and so protect the chlorophyll of young organs; but such a case as the red colour in the lower layers of the floating leaf of a water lily demanded some other explanation."‡ Dr. Bonavia, amid much speculation, has truly written: "Phænogams, such as the carrot and beetroot, develop their orange and crimson colours in what we should consider as total darkness."§ We must all agree with Darwin that "hardly any colour is finer

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correspond with that of the mollusc. The latter may be of an intense black, the shell being quite white; the 'animal' may be a most brilliant creature with a variety of many colours, and its test merely of some uniform sombre hue." (Edgar Smith, 'Roy. Nat. Hist.,' vol. vi. pp. 322–3.)

* 'A Naturalist in Mid-Africa,' pp. 93–4. † 'Darwinism,' p. 302.

‡ 'Royal Institution Lecture,' February 13th, 1896.

§ 'Phil. Notes on Botanical Subjects,' p. 89.

than that of arterial blood; but there is no reason to suppose that the colour of the blood is in itself any advantage; and though it adds to the beauty of the maiden's cheek, no one will pretend that it has been acquired for this purpose." *

All our present knowledge of animal colouration is derived from motive; show us a practical use for the same in the creature's life, either in "protective and aggressive resemblance or mimicry," or in warning or nuptial colours, and the same is at once found to dovetail in that marvellous intellectual conception of this our time, so well known as Darwinism. But let the purpose be unknown, as is the general rule,—though probably no form exists in nature but is the outcome of use, now, or once,—and explanation reaches the standard of pure and scant hypothesis, scarcely to be avoided under the limitations of our present knowledge, nor to be condemned in the absence of experimental test. Poulton has advanced the proposition that the bright hue of many Sea Anemones may be explained under the term and theory of "warning colours," † and that—based on experiments made by Garstang—the tentacles of Sea Anemones were distasteful to fish. ‡ But we learn from McIntosh and Masterman that "it is a well-known fact that adult Cod are extremely fond of Sea Anemones, and some of the rarest species may be procured in their stomachs;" also that Sea Anemones are a favourite bait for Cod in some parts of Scotland. § Darwin has pointed out how colour and constitutional peculiarities go together, and he learned from Prof. Wyman that in Virginia the Pigs were all black because they "ate the paint-root (*Lacnanthes*), which coloured their bones pink, and which caused the hoofs of all but the black varieties to drop off." ‖ Superabundant vigour in the male sex often produces excess or rather extra-development in colour, "as a cock Brambling will occasionally assume a black throat, or a cock Sparrow a chestnut breast, or a Rose Pastor a a reddish head." ¶ Although colours in fruits and plants have in many cases an equally important function as in animals for

* Descent of Man,' 2nd edit., p. 261.

† 'The Colours of Animals,' p. 166. ‡ *Ibid.* p. 200.

§ 'The Life-histories of British Marine Food-fishes,' p. 38.

‖ 'Origin of Species,' 6th edit., p. 9.

¶ J. H. Gurney, 'Zoologist,' 3rd ser., vol. xviii. p. 295.

protection, attraction, or aggression, there are still immense exceptions to the rule. This is particularly evident to anyone who has witnessed the glorious autumnal tints exhibited by the foliage of trees along the mountain slopes of the Rhine and Danube, and on the shores of the Canadian lakes.* These beautiful shades of red, violet, and yellow merely denote the proximate fall of the leaf and chemical processes incidental thereto. Many leaves—due to anthocyanin—are highly coloured on their under surfaces, a process probably which absorbs light and changes it into heat, and thus "in the ever green leaves of those plants in the depths of the forest which are natives of inclement regions, this advantage is obtained from the layer of anthocyanin developed on the lower leaf-surface, that every sunbeam, even in the cooler seasons, can be utilized to the utmost." †

We may probably have reached a stage in our investigations where suggestion may at least be valuable during a halt, and, where consideration may be given to facts, and attention to questions, which do not altogether quite advance new theories nor disprove older ones. Let us bring grist to the mill, even if others alone are capable of producing the meal; surely the naturalist can collate his facts, give his experience, and propound his views, without seeking a "patent" for every idea, or to be the parent of another theory. At the present time, among many students of biology there seems a desire to advocate what may be called a personal theory. Such workers will, with the greatest avidity, dissect and criticise the theories advanced by others. But their own theory is sacred, is, in fact, "totem." This feeling is almost a form of survival. According to Turner, one Samoan saw his god in the Eel, another in the Shark, another in the

* Brehm has described similar autumn beauties in the woodlands of Western Siberia. ('From North Pole to Equator,' p. 130.)

† Kerner and Oliver, 'Nat. Hist. Plants,' vol. i. p. 521. A case which seems to imply non-utility in vegetable markings is given by Prof. Thiselton-Dyer:—"There is a variety of the common oak with marbled foliage. A tree at Tortworth has borne acorns, and these are striped. At first sight it might seem odd that a variation in foliage and fruit should be correlated. But it is not so; the marbling is due to the partial suppression of chlorophyll in those portions of the ground-tissue which are exposed to light; and this tract of tissue is continuous in the leaves and the carpels" ('Nature,' vol. liv. p. 293).

Turtle, another in the Dog, another in the Lizard, and so on through nearly all living things. A man would eat freely of what was regarded as the incarnation of the god of another man, but the incarnation of his own god he would consider it death to injure or to eat. And so it is with our own theoretical bantlings; surely they must live whatever else may perish. As Lecky has remarked of earlier days of the Church: "Whenever a saint was canonized it was necessary to prove that he had worked miracles"; it would appear now, that to be famous as a naturalist, one must be at least original in theory.

There seems at present a danger of being too conclusive, as though the study of animal life is *only* advanced by the promulgation of new views that shall be canonized by a more or less general acceptance; that the observing must be combined with the inventing faculty; that to be behind a theory is to be behind the knowledge of the day. On the other hand, there lurks an opinion, even in powerful and highly qualified quarters, that to suggest a new interpretation of natural phenomena without the most absolute appeal to scientific verification is a deadly sin; that theory is heresy; and that the "romance" of natural history is only expounded by the cautious systematist. Safety seems only possible in the almost forlorn hope of clearing these intellectual Scylla and Charybdis, these opposing schools who both see it all *clare et distincte.*

If we seek to understand animal colouration, the knowledge will scarcely be acquired from the facts to be derived from the world as we know it. As recently remarked: "But we must remember that such protective resemblances—if in reality they exist—are of very ancient date; and that in the early days of mammalian life on the earth the warm-blooded quadrupeds were an exceedingly feeble folk when compared with contemporary birds and reptiles. It is therefore quite possible that many of the characteristic markings upon creatures living to-day—which are often so difficult to explain—are mere vestiges of a state of affairs which existed in very ancient times, and which demanded special means of protection."* If the earliest forms of life are to be sought only in an ancient geological record, it is also in that phase of animal existence that the beginnings of colouration

* Louis Robinson, 'Wild Traits in Tame Animals,' p. 243.

must have developed; and this we may imagine to have been of an assimilative hue, for, as Poulton has remarked, "all animal colour must have been originally non-significant; for, although selective agencies have found manifold uses for colour, this fact can never have accounted for its first appearance."* We may think with Grant Allen, who asserts of the unbroken green hue which was the dominant feature of the flowerless carboniferous era: "Equally unvaried, no doubt, was the hue of the articulate creatures which fed amid those green jungles of tangled fern and club-moss. A few scorpion-like insects, an occasional cockroach, beetle, or other uncanny creeping thing may still be detected in the *débris* of a forgotten world; but no trace of a bee, a moth, or a joyous butterfly can be discovered in these earliest ages of animal life."† Many phases of plant-life can only be understood by a knowledge of past geological conditions. Mr. Harshberger, of Pennsylvania, has recently discussed the origin of the vernal flora of his own land, and has apparently shown that the flowering time of many plants and trees is a direct product of heredity from the glacial period.‡ It therefore seems possible that assimilative colouration may have been a first and very general consequent in animal development; that such a view is suggested by many facts; and that the subsequent protective resemblance acquired by numerous living creatures through the process of natural selection, when life had advanced to the competitive stage, is far too frequently used as an explanation for whole series of uniform phenomena in colouration, which have probably survived unaltered from remote antiquity, and which by their very essence were "outside the law"§ of natural selection, or un-

* 'Colours of Animals,' p. 13.

† 'The Colour-Sense,' p. 38.

‡ 'Science,' new ser. vol. i. pp. 92–8.

§ The reader will readily apprehend that by the term "law" we mean observed, constant, sequence in phenomena. As Prof. Huxley remarks:—"The habitual use of the word 'law,' in the sense of an active thing, is almost a mark of pseudo-science; it characterizes the writings of those who have appropriated the forms of science without knowing anything of its substance" ('Collected Essays,' vol. v. p. 79). And again:—"We have succeeded in finding out the rules of action of a little bit of the universe; we call these rules 'laws of nature,' not because anybody knows whether they bind nature or not, but because we find it is obligatory on us to take them

altered survived as the "fittest." For, as remarked by Paul in a sense that cannot, however, be called biological, that without he had known the law, neither had he known sin; so, until animal life had developed from its little differentiated phase to the advanced stage when a struggle for existence ensued, natural selection scarcely existed as a controlling force. There was doubtless what may be suggested as an evolutionary impulse,*

into account, both as actors under nature, and as interpreters of nature" (ibid. p. 81). John Stuart Mill has given a similar definition ('Three Essays on Religion,' p. 6).

* This evolutionary impulse might be perhaps defined in the words of Matthew Arnold as applied to another subject: "That awful and benevolent impulsion of things within us and without us, which we can concur with, indeed, but cannot create." Apparently similar to the "idioplasm" of Nageli. On the other hand, the terms "impulse" and "stimulus" lack a clear definition. "Here, as in so many similar cases, a phrase, a technical term, a word, is introduced to designate the process observed, and not infrequently those who use it ultimately come to think they have given an explanation of the process, while they really have only stated it. This is especially the case with the term 'stimulus.' What is a stimulus? From the present state of our knowledge we cannot yet give a concise answer to this question, consequently explanations in which this word is inserted are, as explanations, incomplete" (Kerner and Oliver, 'Nat. Hist. Plants,' vol. i. pp. 776–7). Mr. Mivart would apparently recognize this internal force as "instinct," postulating: "Instead, then, of explaining instinct by reflex action (as a reflex action accompanied by sensation), I would explain reflex action, processes of repair, and processes of individual and specific evolution, by Instinct—the wonderful action and nature of which we know as it exists in our own personal activity" (Proc. Zool. Soc. 1884, p. 473). Mr. Orr uses several equivalents, such as *elementary nervousness*, "which makes possible and necessary the formation of co-ordinations and associations as the result of repetition of the necessitated reactions." *Inherited impulse of growth*, "which in combination with external forces constantly drives the organism forward on its course of development, and, even while the environing forces remain the same, is constantly exposing the developing individual to new stimuli, because it is constantly changing the individual." *Hereditary impulse*, "which is the result of the long previous history of the organism" ('Theory of Development and Heredity,' pp. 108, 143, 198). In all these terms we are reminded of the "internal perfecting tendency" of Aristotle. Again, Kölliker's idea of the evolution of forms from "internal causes" on the basis of a "general law of evolution"; Kölliker subsequently explained that his internal causes were physico-chemical (see Eimer, 'Organic Evolution,' Eng. transl. pp. 49, 50). Mr. Dixon recognizes this factor in the migration of birds: "Young birds *are not* born with this hereditary know-

subject to many conditions, of which at present we know as little of one as the other. This phenomenon may be seen in many ways, quite independent of environmental conditions. Plants would certainly be thought to flower in response to the climatic conditions of the year; yet Kerner observed the earliest date of flowering of a number of willows growing in the Botanic Garden at Innsbruck for a period of twelve years, and thus not only arrived at an average date for the first opening of the male flowers in some fifty different kinds of *Salix*, but, as he remarks: —"It will be observed that the two alpine willows, *Salix retusa* and *S. jacquiniana*, flowered on an average in the twelve years on the same day, and that their hybrid, *S. retusoides*, kept also to that date."* Again, every angler knows—at least everyone of experience and observation—that, as the Countess of Malmesbury has expressed it, "each river has certain hours during which the fish rise in preference to any other."† But the "law" of natural selection had as much a beginning in time, and in biological time, as the "moral law"—practised in some form or another by the greater part of mankind—must have been unknown to our more bestial ancestors; little understood by prehistoric man, and only fully developed as human civilization and slavery advanced hand in hand, through peace and plenty, through misery and despair. In fact, the term "natural law" is as loose and ill-defined as that of "moral law." All that we see, all that we can reduce to rational conception, are natural phenomena, different or more evolved to-day than what little we know of them in the past; while that scanty record represents merely an appreciation of a form of evolution which took place in time estimated only by theoretical calculation, and under conditions of which we practically know nothing. We see sequences of natural phenomena, which we call natural laws, and we can no more realize the antecedents of these phenomena than we can conceive an era when our so-called natural laws were neither existent, necessary, nor consequent. We are thus compelled to seek a time prior to or independent of natural selection, or else logically to apply it

ledge, but only with a strong inherited impulse to undertake the habit or function" ('The Migration of Birds,' amend. edit. 1897, p. 100).

* Kerner and Oliver, 'Nat. Hist. Plants,' vol. ii. p. 574.

† 'Badminton Mag.' vol. i. p. 43.

as a law acting through space and time; so that we narcotise our mind with a new dogma: not that in the beginning was the "word," but "natural selection."

This endeavour to make natural selection the all and all of evolution* has in some cases brought about a reaction which denies its efficacy *in toto*. Thus the Rev. G. Henslow, in a recent interesting work, ascribes the origin of species "to the joint action alone of two great factors of evolution—variability and environment." Mr. Henslow does good service in recording a large number of facts and observations, which go to prove to demonstration that the environment largely induces the form and structure of vegetable life, and he formulates the proposition that these features are due "to the responsive power of protoplasm, which, under the influences of the external forces of the environment, builds up just those tissues which are the best fitted to be in harmony with the environment in question."† But, alas! *La phrase est le tyran de notre siècle.* The term "responsive power of protoplasm" is, like that of "germ plasm," workable, but unprovable. It refers to a fact, and seeks to explain it by a suggestion. But even if we accept this "responsiveness of protoplasm to the environmental conditions," natural selection is not banished, but only limited. It is still a cause, but not an absolute one; it has had an elementary and preserving process in a stage of life it did not create. Thus, if spinescent characters in plant-life seem undoubtedly due to drought, and usually possess an arid environment, as one may read who ever gazes on the Transvaalian veld, plants still survive, and could only have survived the effects of the foraging powers of the immense herds of ruminants which formerly swarmed over the land, by the possession of spines of defence.‡ Although these animals are

* Darwin himself distinctly stated, and again reaffirmed, "I am convinced that natural selection has been the main but not the exclusive means of modification" ('Origin of Species,' sixth edition, p. 421).

† 'Origin of Plant-Structures,' p. 14.

‡ Dr. Meyer, quoting Grisebach ('Vegetation der Erde'), and detailing his own observations in East Africa, writes:—"The plants are protected on the one hand against drought, and on the other against animals, by a partial suppression of the leaves, of which in a certain number the fibro-vascular bundles become indurated and form thorns from an inch and a half to two inches long. . . . It is self-evident that with such a suppression of the foliage

now practically extinct from so many areas, their former presence is proved by the hard-wooded and spinous trees and shrubs which have almost alone survived. And thus natural selection has acted on the original flora and fauna in which this obscurely understood evolutionary response to environmental conditions played such a vast and primary part. Natural selection is not the act of creation, but the effect of competition; it guides the battles, and directs the forces it did not provide. There seems indeed some prospect of "natural selection" being relegated by some writers to the old armoury of teleology. Thus a recent writer has remarked that it is held by "Wallace and others among our deeper-thinking naturalists, that the workings of natural selection are incomprehensible unless we regard them as guided by a controlling intelligence."* A much more weighty argument is "that the conception of the struggle for existence has derived its force, not wholly from actual observation of what occurs, but very largely from inference as to what, it is believed, must occur."†

We may, however, quit these realms of suggestion, and observe how even in our scanty geological records we see exhibited some phases of the commencement of a struggle for existence. Thus, after a period of animal evolution which may be computed by millions of years, and in which fish abounded, perhaps not yet altogether under a severe stress of selection and survival, the Mesozoic period arrives, when, in the words of Oscar Schmidt, "the Placoids and Ganoids, hitherto predominating in the ocean almost without a foe, now found overwhelming enemies in the true Sea-lizards or Enaliosaurians, especially the Ichthyosaura and Plesiosaura."‡ Here we see natural selection, with its iron and implacable rule, a real factor

there must be a corresponding diminution of transpiration, and the tree is enabled to preserve its sap when, during the dry season, its roots cannot any longer obtain a supply of moisture" ('Across East African Glaciers,' p. 68).

* Kirby, 'Nature,' vol. liii. p. 77.

† Thomson, 'Natural Science,' vol. viii. p. 22. The Right Hon. A. J. Balfour has now invoked—perhaps sarcastically—the aid of "natural selection" to account for such a theological conception as "free will" ('Foundations of Belief,' p. 20).

‡ 'Doctrine of Descent,' p. 74.

in the lives and development of these creatures, connected and increasing with an advancing animal evolution, but still only a term to express the modifying influences incidental to a struggle for existence.* In fact, natural selection is more an effect than a cause. It was incidental and consequent to the progress of evolution in animal life, and ever increasing its sway in ratio with the vast increase of living things became the giant modifying influence, and modelled, painted, exterminated, and sustained the fauna and flora which by their dangerous fecundity came under her rule. But because a phenomenon is ancient it is not necessarily eternal—theologians discuss those questions—and if logic imperatively demands an antecedent to natural selection, biology must refuse to recognize that undoubtedly mighty and modifying influence as a First Cause.† "We attach too exclusive an importance to adaptation . . . when we think to explain by selection every similarity between the colouring of an animal and that of the ground on which it lives. For, as we have seen, animals may become similar in colour to their surroundings, actually adapted in colour, quite by chance; for instance, in consequence of the direct necessary action of light, *i.e.* of the surrounding colours, and therefore without selection, many really wonderful cases of adaptation, apparently due to selection, probably come under the category."‡

It seems a probable suggestion that assimilative colouration was a very constant factor in an early stage of animal life, and

* To understand the philosophical conceptions in Biology previous to the Darwinian epoch, which may be said to have commenced with the publication of the 'Origin of Species' in 1859, we may with the greatest instruction reperuse the 'Essay on Classification,' written by that master naturalist, Agassiz, the preface of which bears date 1858, the same year that simultaneous papers by Darwin and Wallace were read before the Linnean Society, and the way made straight for the theory of natural selection. In the essay of Agassiz only three references are made to Darwin, and those purely bibliographical, recording more or less *technical memoirs*. In a philosophic sense the 'Essay on Classification' may be described as the last charge of the Old Guard.

† It will be remembered that Mr. Mivart has brilliantly advanced his thesis that "species have been evolved by ordinary *natural laws* (for the most part unknown) aided by the *subordinate* action of 'natural selection'" ('Genesis of Species,' p. 333).

‡ Eimer, 'Organic Evolution,' Eng. transl. p. 144.

that it has come down as a survival to the present day in a host of instances to which we have applied the explanation of "protective resemblance." The reason why it has thus survived is not because it contradicts, but because it does not require the modifying influence of natural selection. It neither broke the "law," nor did it arise through the controlling action of the "law"; and where species uninfluenced by the impulse of variation, or unharmed by a too rapid or excessive fecundity, existed in assimilative colouration to the surroundings which have remained unchanged, and subject to no climatic changes enforcing migration, such species have survived, and do appear to-day, in their original assimilative colouration.

The suggestion receives support from many facts recorded by travellers and naturalists, which, taken singly, have only the appearance of curious observations, but, considered together, exhibit more cumulative force. According to Dr. A. Leith Adams, "there is, moreover, a seemingly strong disposition for the lower parts of animals to become white in winter, *i. e.* the parts in closest contact with the snow; thus, the under surfaces of the Deer tribe are always whitest."* Mr. J. Newton Baskett would seem to favour the same suggestion with regard to the colour of birds' eggs:—"To my mind the suggestion comes that many of our early birds with spotted eggs may have reverted from green and dead grass nesting to shingly or brilliant pebbly regions, carrying with them the bluish, greenish, creamy, or drab grounds, and by that tendency to variation for which we can never account—a thing as mysterious as life itself—they here, through the agency of natural selection, began a mottled colour-adaptation which has developed so highly in our shore birds, Gulls and their relations."† The well-known and much-quoted observation made by Canon Tristram in North Africa cannot be omitted here:—"In the desert, where neither trees, brushwood, nor even undulation of the surface afford the slightest protection to its foes, a modification of colour which shall be assimilated to that of the surrounding country is absolutely necessary. Hence *without exception* the upper plumage of *every bird*, whether Lark, Chat, Sylvain, or Sand Grouse, and also the fur of *all the smaller*

* 'Field and Forest Rambles,' p. 124.

† Papers, "World's Congress on Ornithology," Chicago, pp. 97, 98.

mammals, and the skin of *all the Snakes and Lizards*, is of one uniform isabelline or sand colour."* Brehm writes:—"The birds, the reptiles, and even the insects show the same stamp, though form and colouring may vary greatly. When any other colour besides sandy yellow becomes prominent, if hair, feather, or scale be marked with black or white, ashy grey or brown, red or blue, such decorations occur only in places where they are not noticeable when looked at from above or from the side."† But he also remarks:—"The fact that almost all the desert animals agree in colouring with their surroundings explains why the traveller who is not an experienced observer often sees, at first at least, but little of the animal life." ‡ This appears to better illustrate the survival of an original assimilative colouration than to afford an example of the strict definition of what is meant as "protective resemblance," which affords an extraneous means of survival under an increased competition of life. Mr. Beddard, discussing the effects of temperature and moisture on the colours of animals, considers it "at least possible that the tawny colours of desert animals, which have been so often brought forward as an instance of adaptation to the hues of their environment, may be due to a similar cause."§ Mr. Quelch, writing on the Birds

* 'Ibis,' vol. i. p. 429. I do not remember meeting with this remark in the Canon's 'Great Sahara,' and it may have been an observation recalled when the specimens were more closely examined. Such reflections are no less valuable when subsequent considerations. Some exceptions to this rule were, however, given by Canon Tristram to Mr. Darwin: "Thus the male of *Monticola cyanea* is conspicuous from his bright blue colour, and the female almost equally conspicuous from her mottled brown and white plumage; both sexes of two species of *Dromolæa* are of a lustrous black; so that these three species are far from receiving protection from their colours; yet they are able to survive, for they have acquired the habit of taking refuge from danger in holes or crevices in the rocks" ('Descent of Man,' second edition, p. 456). According to Dr. Merriam: "The theory of the direct action of environment in modifying colour, as in the bleached types of the desert regions, is not borne out by observations, and is disproved in the case of nocturnal types" (Balt. Meet. Am. Soc. Nat.; see 'Science,' new ser. vol. i. p. 38). Another American authority—Mr. Orr—accepts the theory, and remarks:—"Living matter seems to be in a general way capable to a certain extent of photographing colours when exposed for many generations" ('A Theory of Development and Heredity,' p. 50).

† 'From North Pole to Equator,' p. 336. ‡ *Ibid.* p. 331.

§ 'Animal Coloration,' 2nd edit. p. 60.

of British Guiana, states that "the purple tints on the throat, breast, and body of *Cotinga cayana*, *C. cærulea*, and *Xipholena pompadora* can be changed to a brilliant red by exposing them to heat in such a way as to affect those feathers without singeing—an indication of the possibilities in nature under changing thermal conditions."* Where everything is of one assimilative hue, such universal protection—if it were such—would rather tend to neutralization in all such properties, and other qualities would be necessary in the struggle for existence, the absence of which might mean starvation and extermination to many species, or *vice versâ*—the correlative undue multiplication of others; facts which certainly do not appear on the surface. An American writer in studying the same problem has given a similar opinion. As he observes, "its tendency is to bring the colours of the animals to agree with those of its surroundings; for this reason it has been classed as protective colouration, notwithstanding the fact of its occurrence on all the species of a locality whether in need of protection or not." † The very essence of the theory of protective resemblance, as a means of survival consequent upon the slow but sure action of natural selection, is a special, not a general effect,—a particular, not an universal attribute,—but one of the many and diverse qualifications which enable animals and plants to survive in the competitive struggle for existence. If such a suggestion is reasonable or probable, we ought at least to find some supportive facts, and these can be gathered, though scantily, for the observations of travellers and naturalists do not appear to have been greatly attracted in that quarter.‡ M.

* Papers, "World's Congress on Ornithology," Chicago, p. 124.

† Garman, 'Proc. Am. Ass. Buffalo, N. Y.' 1876, p. 200.

‡ We must, however, carefully guard against hasty or erroneous observations. Thus the early South African traveller, Le Vaillant, was told of a race of red Elephants, which he afterwards observed were of the same tint as the soil on which they were found. But after killing one he proved his surmise, that the colour was only due to their wallowing in moist and marshy places ('Travels in the Years 1780-85,' Eng. transl. vol. i. p. 266). Again, Von Höhnel describes the hairless bodies of old male Buffaloes in East Africa as being of "the colour of the mud—black, grey, brown, or reddish brown, as the case may be—in which they last wallowed" ('Discovery of Lakes Rudolf and Stefanie,' Eng. transl. vol. ii. p. 21). Chanler has a similar observation as to a "red" Rhinoceros ('Through Jungle and Desert, p. 120).

Porchinsky, one of a scientific party engaged in exploring the Caucasus, also witnessed a nearly complete phenomenon of assimilative colouration. The southern limit of the region explored was the steppe of Erivan, a plain covered with sand, with some patches of variously coloured clays appearing in the low hills. A remarkable feature of the animal inhabitants of the steppe, insects and reptiles, and especially of the Lizards, is the most perfect agreement of their colouration with that of the steppe. The same thing was also observed in the steppe of Elizabethpol.* This is a similar observation to that made by Canon Tristram in North Africa, and induces the same comment. Dr. A. Leith Adams remarks:—"The colour of the plumage of many desert-loving birds, like the denizens of arctic regions, assimilates to that of surrounding objects, and, moreover, as has been truly said, we also find the bleaching influence of the desert, and the dry and cloudless climate imparting their hues to the Egyptian monuments. So much is the latter the case that the eye fails at first to receive an impression of their immense antiquity, owing to the absence of the grey colouring and weather stains which give so venerable an aspect to those of Northern Europe. There is thus a stamp imprinted on all the animate and inanimate objects, in accordance with their haunts, as, for example, the desert Chats and other birds are much paler in colouring than those which frequent the cultivated districts on the river's banks."†

If this appears to be evident on the surface of the earth, the same phenomena seem to exist in the abyssal depths of the ocean. From recent deep-sea researches we know that the floor of the ocean is probably a vast undulating plain of mud; and, to quote both Sir John Murray and Mr. Hickson, of all the deep-sea deposits, the so-called "red mud" has by far the widest distribution. According to the testimony of the late Prof. Wyville Thomson and his colleagues in the 'Challenger' Expedition, this red clay is the residuum left after the calcareous matter of the *Globigerinæ* ooze has been dissolved away; and Sir John Murray is of opinion that "probably the majority of deep-sea species live by eating the surface-layers of the mud, clay, or ooze at the bottom, and by catching or picking up the

* Commun. to St. Petersb. Entomol. Soc.; see 'Nature,' vol. xv. p. 16.

† 'Naturalist in the Nile Valley and Malta,' pp. 50, 51.

small organisms or minute particles of organic matter which fall from the surface, &c."* Now how far does assimilative colouration appear to obtain in these dreary depths? Sir John Murray speaks of the "red and brown tints of the majority of deep-sea organisms."† Mr. Hickson's statement that "the deep-sea fish are usually devoid of any pronounced spots, stripes, or other markings is now well recognized," and it seems to be "a very general rule among fishes that as they migrate into deeper water the spots and stripes so conspicuous among many forms living on the surface and in shallow water disappear, and the colouration of the body becomes more evenly distributed and uniform." "Among the Crustacea various shades of red are the prevailing colours." "The colouring of the deep-sea jelly-fishes is said to be usually deep violet or yellowish red." "Moseley records most minutely the colour of some of the deep-sea anemones and corals, and calls attention to the very general presence of madder-brown in the soft parts." "The pelagic Schizopoda are usually quite pale and transparent; the deep-sea forms, on the other hand, are frequently, if not invariably, of a bright red colour." Mr. Hickson concludes that the fauna of the deep sea, taken as a whole, is not characterized by the predominance of any one colour, but "the shades of red occur rather more frequently than they do in the fauna of any other zone or region."‡ Mr. Beddard, arguing from the many cases of degenerate eyes among deep-sea animals, considers it reasonable to suppose that vision is impossible. "The inevitable conclusion, therefore, from these facts appears to be that the brilliant and varied colourations of deep-sea animals is totally devoid of meaning; they cannot be of advan-

* 'Compte-Rendu,' Third Inter. Congr. Zool. Leyden, p. 107. "The scientific men engaged in the 'Challenger' Expedition came at last to the conclusion that the red clay was mainly produced by the decomposition of inorganic material, such as the pumice discharged into the air during volcanic eruptions, which after long floating about on the surface of the sea must become waterlogged, and sink together with the various kinds of dust already mentioned. The evidence which they cite indicates that this red clay accumulates very slowly, and that it owes much to the above materials; but that some part of it may be, directly or indirectly, due to chemical action does not seem improbable" (T. G. Bonney, 'Story of our Planet,' p. 209).

† 'Compte-Rendu,' Third Inter. Congr. Zool. Leyden, p. 107.

‡ 'The Fauna of the Deep Sea,' pp. 61, 62, 63, 65, 66, 135.

tage for protective purposes or as warning colours, for the single and sufficient reason that they are invisible."* Some shore species of crustaceans are found to turn red when kept in the dark; hence Mr. Faxon is inclined to believe that in the deep-sea species the prevalence of red is "due to a modification of the pigments, induced by the darkness in which the creatures dwell, either through chemical action, or more probably through a physiological process originating in the eye, and affecting the pigment-cells by a reflex action. In either case the prime cause is a purely physical one—the more or less complete absence of light in the depths of the sea." . . . To those who may enquire why deep-sea crustaceans should be red-tinted in general rather than of any other colour, Mr. Faxon quotes Pouchet's explanation, that "the pigments of the xanthic series (red, orange, and yellow) in Crustacea are contained in contractile anatomical elements—the chromatoblasts—while the blue pigment is never found in the substance of the chromatoblasts, but is held in free solution." "Under the influence of the abyssal darkness there is supposed to be so great an expansion of the red chromatoblasts that any effect from the cyanic tints is completely overpowered."† Another explanation has been advanced to account for a similar colouration of the deep-sea flora. The blue colouration of the water is due to the decomposition or absorption of the red, orange, and yellow rays of light in their passage through the water, and owes its hue to those rays of high refrangibility,

* 'Animal Coloration,' 2nd edit. p. 37.

† Review in 'Nat. Science,' vol. viii. p. 119, of "Reports on an Exploration in charge of A. Agassiz by s.s. 'Albatross,' 1891, xv.: the Stalk-eyed Crustaceans," by Walter Faxon.

As regards the deep-sea fishes, according to Dr. Günther, their colours "are extremely simple, their bodies being either black or silvery; in a few only are some filaments or the fin-rays of a bright scarlet colour. Among the black forms albinos are not scarce" ('Introd. Study of Fishes,' p. 300). On the other hand, fishes do exhibit assimilative colouration. Mr. Brown-Goode writes:—"On certain ledges along the New England coast are rocks covered with dense growths of scarlet and crimson seaweeds. The Codfish, the Cunner, the Sea-raven, the Rock-eel, and the Wry-mouth, which inhabit these brilliant groves, are all coloured to match their surroundings; the Cod, which has naturally the lightest colour, being most brilliant in its scarlet hues, while others whose skins have a large and original supply of black have deeper tints of dark red and brown" ('Science,' vol. xv. p. 211).

such as the blue, which are allowed to pass through. "The rays on the further side of the red, not perceptible to our eyes—the so-called dark heat-rays—are likewise absorbed in their passage through the water, and an object at some depth under water would therefore only be reached by rays of high refrangibility, particularly blue rays. The conditions of illumination for plants growing in the depths of the ocean are consequently in reality quite unfavourable. It is not only that a portion of the light falling on the surface of the water is reflected, and the other portion is weakened by its passage through the water, but besides, those rays which are necessary to the formation of organic matter by the chlorophyll granules in the plant-cells are abstracted from the light which passes through; for the chlorophyll granules need just the red, yellow, and orange rays if they are to perform their functions; only under the influence of these rays can the decomposition of carbonic acid, the separation of oxygen, and the formation of carbohydrates take place. The blue rays do not assist at all in this respect; they are even hurtful to these processes, since they assist the oxidation—that is, the decomposition of organic substance. Consequently, phycoërythrin, the red pigment of the *Floridæ*, now appears, and indeed so abundantly, that the chlorophyll granules in the interior are quite hidden by it. This colouring matter displays a very marked fluorescence, that is to say, it absorbs a large portion of the light rays falling on it, and gives out other rays of greater wave-length. The blue rays are to some extent changed by it to yellow, orange, and red, and thus the chlorophyll granules finally receive those rays which act as the propelling force in the decomposition of carbonic acid. But this also affords an explanation of the remarkable phenomenon that sea-plants are only coloured green close to the shore, and only in the most superficial layers of water, while lower down they appear red. Only quite on the surface the emerald-like *Ulvaceæ* and *Entermorphas* sway hither and thither, forming thus a light green belt; these algæ are to be sought for in vain in the depths beneath. Of the plants which flourish below this region it can no longer be said that they grow green; this mark of vegetation has entirely vanished. Green has given place to red. All the innumerable *Floridæ* are reddened—sometimes a delicate carmine, sometimes a deep purple; then again a light brownish red,

and a dull dark crimson."* As further remarked:—"In the dark bosom of the earth a green leaf would be quite useless, and as a matter of fact there is not a single plant whose green tissue is situated in the depths of the soil." †

Even the obscure problem of the colouration of mankind may have originally—and before migration became such an important factor in modification—been due to a more or less assimilative colouration. Thus, in Central Africa, Schweinfurth has remarked:—"The complexion of the Bongo in colour is not dissimilar to the red-brown soil on which they reside; the Dinka, on the other hand, are black as their own native alluvium." And again:—"Any traveller who has followed the course of the main sources of the White Nile into the heathen Negro countries, and who has hitherto made acquaintance only with Shillooks, Nueir, and Dinka, will, on coming amongst the Bongo, at once recognise the commencement of a new series of races extending far onwards to the south. As trees and plants are the children of the soil from which they spring, so here does the human species appear to adapt itself in external aspect to the red ferruginous rock which prevails around. The jet-black Shillooks, Nueir, and Dinka natives of the dark alluvial flats stand out in marked distinction to the dwellers upon the iron-red rocks, who, notwithstanding their diversity in dialect, in habit, or in mode of life, present the characteristics of a connected whole." ‡ Dr. Schweinfurth also observes that "the circumstance is suggestive of Darwin's theory of 'protective resemblance' among animals." But as such a view of protective resemblance has not hitherto been applied to the colour of mankind, and as it would be extremely difficult to defend such a proposition, it might at least be suggested as probable that we have here another survival of an original and somewhat universal assimilative colouration. Similar observations have been made by many travellers. Livingstone describes the colour of the soil composing the plain of the Kalahari Desert as in general "light-coloured soft sand, nearly pure silica," § and that the Bushmen inhabiting these plains are

* Kerner and Oliver, 'Nat. Hist. Plants,' vol. i. pp. 389–90.

† *Ibid.* p. 665.

‡ 'The Heart of Africa,' vol. i. p. 261.

§ 'Miss. Travels and Researches in S. Africa,' p. 47.

generally of a "light-yellow colour."* In Equatorial Africa, Emin Pasha states that the people of Magúngo are of a black colour, "through which, however, appears very distinctly a red ground tone"†; and he further describes "a streamlet dyed red with the iron that impregnates the soil."‡ In Unyóro the same author writes of the exposed "red clayey subsoil,"§ and describes the people of this district as reddish brown in colour.‖ Again, in the Wádelai district, he writes of the inhabitants as "in colour black, with a reddish brown tinge."¶ In Mashonaland Mr. Eckersley states that the soil of the plateau between Umtali and Salisbury consists, for the most part, of decomposed granite, &c. "Large areas of red soil are, however, frequently met with," &c.** Of the Mashonas, he writes: "Their skin has a fine healthy glow, its colour being dark chocolate brown, some shades removed from black."†† According to Ratzel, "Stokes, one of the most experienced of all Australian travellers, sums up his judgment in the phrase, 'The Australians vary as curiously as their soil.'"‡‡ Lord Geo. Campbell in one of the Fiji islands, describing the men engaged on the yam-grounds, adds: "Working on the brown soil, which is very much their own colour too."§§ Richtofen, in a work—apparently still untranslated into English—in his physical exposition of the soil of Northern China, to which the German name of *Löss* has been applied, states that this *Löss* is so predominant in the basin of the Wei river, on which stands Singanfu, that its yellow hue affects the whole landscape, and even tinges the atmosphere.‖‖ Its suggested partial application here to the colour of the Chinese, as an incident in the argument, requires no further emphasis.

* 'Miss. Travels and Researches in S. Africa,' p. 78.

† 'Emin Pasha in Central Africa,' p. 16.

‡ *Ibid.* p. 20. § *Ibid.* p. 50.

‖ *Ibid.* p. 52.

¶ *Ibid.* p. 143.—According to Dr. Junker, "a decided black complexion nowhere occurs, and that it would be merely more correct to speak of a brown, a copper, or chocolate-coloured, than of a black race in Africa" ('Travels in Africa, 1879–1883'; Engl. transl. p. 190).

** 'Geographical Journal,' vol. v. p. 35. †† *Ibid.* p. 43.

‡‡ 'History of Mankind,' vol. i. p. 339.

§§ 'Log Letters from the "Challenger,"' p. 147.

‖‖ 'China—Ergebnisse eigener Reisen und darauf gegründeter Studien.'

It is true that assimilative colouration seems to have little modified the colour of indigenous races, even in Africa, if we take a comprehensive view of the whole area. But we must not forget that men have so often migrated from their original birthplaces, and more than that, much mixture has taken place. Emin Pasha remarks on "the intermingling of separate tribes and peoples in Central Africa consequent upon war, plundering raids, dividing of the spoil in women, slavery and exchange of slaves, and in a much less degree on intermarriage"; and further, "that it is almost impossible to obtain skulls of really pure race." He also observes: "Whether the great variation in the colour of the skin observable among all Negro tribes is to be attributed to these mixed relationships, I do not venture yet to decide." *

The relationship between the surface hue of the geological floor on which the primary races of men may have developed their individuality of colour, and the prevalent tints of those races, has been little studied, though that investigation might also throw much light on the areas where racial segregation established those divisions which in any other group of animals would at least be considered specific. Even in our own country this old connection between land and man has been pointed out by the late Prof. Ramsay: "Thus it happens that the oldest tribes now inhabiting our country are to be found among the old palæozoic mountains, which, composed of the most ancient of our geological formations, and rising up into the highest grounds, must have been the first parts of the British islands to rise above the waters during the last elevation of the land." † This observation is doubtless capable of more universal application, and human assimilative colouration might prove a reasonable hypothesis if we could only trace the early dispersal of our species in a scientific manner and spirit, without the aid of a Hebraistic "Tower of Babel," or the view once advanced by ethnologists of a Caucasian nursery based on a still earlier attempt to locate the "Garden of Eden." The boldest of new theories are at least not more grotesque than the *explanations* of quite recent times, and whereas the last were believed to be final, the first are advanced only as propositions for future verification or

* 'Emin Pasha in Central Africa,' p. 197.

† *Cf.* Extracts from Lectures—'Anthropological Review,' vol. i. p. 486.

dismissal. Even journalism has referred to the connection between land and man, and a writer in the 'St. James's Gazette' (January 6th, 1881) on the London Clay remarks:—"In the old days all London lay upon the few scattered patches of pleistocene gravel which here and there cap the surface, because it was only on the gravel that water could be obtained from springs or wells. Hence the original development of the suburbs, as Prof. Prestwich has pointed out, followed with unerring precision the zig-zag course of the pleistocene tracts." "In Caithness the best cereals, cattle, and men were raised on the boulder clay, and where it was wanting, the corn, cattle, and men were miserable."* Frank Buckland states:—"The geological formation of a district I found, in examining recruits for the regiment, has considerable effect upon the stature of its inhabitants; *coal-producing* counties, as a rule, generally grow the tallest, and, at the same time, the largest-boned men."†

But although facts may be found to support new suggestions, such as a possible original assimilative colouration of man, the quest for such produces other recorded observations, which, though not altogether contradictory to the view, still point to other causes, support other conclusions, and reassert the problem we seek to solve. Thus we find indications of the influence of food in human colouration. The ship "Strathmore" was wrecked upon one of the rocks of the "Twelve Apostles," an island in the Crozet group, on July 1st, 1875, and the survivors of the passengers and crew, before being rescued, remained there for a period of six months and twenty-two days. Of the events that occurred during that time we have the narrative of Mrs. Wordsworth and her son. Speaking of a period four months subsequent to the wreck, and when Penguins' eggs had begun to furnish the castaways with ample food, Mrs. Wordsworth remarks:—"The eggs did everyone a great deal of good; those who had been

* Cleghorn, 'Anthropological Review,' 1868, No. 20, p. xxi.

† 'Curiosities Nat. Hist.,' popular edition, 4th series, p. 9.—A similar observation is recorded by Mr. Atmore in South African ornithology:—"The Rock-chat (*Saxicola cinerea*) is abundant in the Karroo—and, by the way, how well this class of birds obeys the geology of the country; wherever there is Karroo soil you find them. The same also with the 'Kalkvent-je' (*Macronyx capensis*), which is found in every patch of grass country, but never in Karroo soil" (Layard's 'Birds S. Africa,' Sharpe's edition, p. 242).

haggard and miserable got quite plump and fresh; some of them ate about thirty at a meal, and we now saw each other with clean faces, for we used the eggs as soap; while a most remarkable thing was that everyone had fair skins and light hair, dark faces and hair being quite changed, black hair turning brown or red, and fairer people quite flaxen. As for myself, my complexion was pink and white, like a girl's" (this after four months' constant exposure to the weather), "with white eyebrows, yellow hair, &c." The survivors were rescued on Jan. 21st, 1876, and the same lady subsequently writes:—"Charlie looks well and firm now, his hair had got quite flaxen, which did not suit him at all, but now it has nearly recovered its original colour."* Here, presumably, the colouring factor is considered as the constant diet of Penguins' eggs. As Darwin has observed: "There can, however, be little doubt about many slight changes, such as size from the amount of food, colour from the nature of the food."† Climatic conditions are not altogether inoperative, and an extreme case is recorded by Andersson in the Ovambo country, South-west Africa. In describing the bitterly cold nights experienced in the month of June, he states that one of his men, Timbo, a native of Portuguese East Africa, suffered much from the low temperature, and one morning the members of the expedition were amazed at finding "his dark shiny skin suddenly changed into a pale ashy grey."‡

The view of a direct action caused by a constant food on animal colouration has frequently been remarked. Mr. Harvie Brown thought that the Sand Martin might derive its black or dark-coloured plumage in North Russia by constant feeding on Mosquitos.§ Most natives of Brazil take pleasure in intercourse with animals. They are in the habit of attaching Monkeys and Parrots to themselves, and by feeding the latter on fish they produce red and yellow feathers when the plumage is green.‖ The Bullfinch is well known to turn black when fed on hemp-seeds, and the Canary to become red when fed on cayenne pepper.¶ According to Mr. Harting, "Bullfinches are not the

* 'Nature,' vol. xiv. p. 527 (quoted from 'Blackwood's Magazine').

† 'Origin of Species,' 6th edition, p. 6.

‡ 'Lake Ngami,' p. 210.

§ 'Zoologist,' p. 5162.

‖ Oscar Peschel, 'The Races of Man,' p. 423.

¶ Romanes, 'Darwin, and after Darwin,' vol. ii. p. 218.

only birds which have been observed to turn black from feeding on hemp-seed, nor is hemp-seed the only seed which conduces to such a change of colour. Larks have been known to become black after being fed for some time on hemp-seed; and the late Mr. Blyth informed us that he had seen one of the little Amandavat Finches which had become black, though fed entirely on canary-seed."* Again, there is the "change produced in so many of the Green Parrots by the native peoples of Guiana, who, by feeding these birds on a special diet, consisting largely of pounded corn or maize, produce eventually yellow-coloured birds."† A pair of American Screech Owls (*Megascops asio*) which were fed in captivity largely on liver, and which were originally in typical grey plumage, exhibited subsequently, especially in the larger female Owl, an actual change from grey to red-brown in individual feathers, and the red phase was not thought entirely, if at all, due to new feather-growth.‡ By mixing madder with the food of a female mammal, Flourens produced a red colour in the bones of the fœtus. By placing the eggs of a Salmon Trout in waters which only nourished White Trout, Coste noticed the eggs became gradually paler, and produced Trout which had lost the characteristic colour of their race.§ "If a Horse has an addition of arsenic to its usual food, its hair becomes more glossy; and Holmegreen has proved that if Pigeons are fed with meat they change not only the colours of their feathers, but also their odour."‖ In the Salmonoids the flesh is frequently of a marked pinkish hue, "brought about by the crustaceans on which these carnivorous fishes so largely feed."¶ By changing or varying the food of lepidopterous larvæ, much variation has been produced in the depth of colour of the imagines.**

The whole problem of the colouration of mankind centres largely on the question of what was the tint or hue of the skin of

* 'Nat. Hist. Selborne,' Harting's edition, p. 118, *note*.

† J. J. Quelch, Papers, "World's Congress on Ornithology," p. 124.

‡ A. P. Chadbourne, 'The Auk,' new series, vol. xiii. p. 321.

§ De Quatrefages, 'The Human Species,' p. 247.

‖ 'Problems of Nature, Researches and Discoveries of Gustav Jaeger,' Engl. transl. p. 38.

¶ Lydekker, 'Roy. Nat. Hist.,' vol. v. p. 494.

** *Cf.* Kock, Goss, Gregson, and others.

our earliest ancestors; not altogether what we mean by "primitive man," but rather of the creature that gradually became less simian, and more and more human. Of this missing link we know absolutely nothing as to the colour of its—or perhaps we should say his—skin; neither do we of the colour of fossil Apes. As Dr. Büchner has remarked: "The Orang or Orang-outan which inhabits the Asiatic Archipelago is of a *yellowish red* colour and *brachycephalous*, or short-headed, like the Malays; whilst the Chimpanzee and the Gorilla, both of which are indigenous to Africa, are black and *dolichocephalous*, or long-headed, like the Negroes."* There is also much truth in the statement of Winwood Reade, that many ethnologists discuss the question as though the original colour of mankind was white; "but the naked primeval men were probably dark, for white is a colour injurious to wild animals, and seldom if ever found in the fauna of the forest."† Of fossil Apes we know more or less of the anatomical structure, but our conclusions as to colour can only be equivalent to our pronouncing the colour of a prehistoric man whose skull was found in Africa as black; of one found in Europe as necessarily white; or another discovered in America as red. That secret belongs entirely to the past, and its solution can only be suggested by induction. As De Quatrefages has remarked: "The first men who peopled the centre of human appearance must at first have differed from each other only in individual features."‡ Their colour would have been uniform, either derived from their more brutish ancestors, or possibly, as their habits became less arboreal, a more assimilative colouration may have ensued to the soil on which they walked. Then, as migrations followed and the more plastic forms of these last evoluted children of nature reached centres of different geological conditions, we might imagine that again assimilative colouration played a part; and these incidents of early wanderings and colour absorption of the long, long ago, when the species was still clay in the hands of Nature,§ the potter, gradually became permanent,

* 'Man—Present, Past, Future,' p. 125. With reference to colour, the observation had also occurred to Agassiz. ('Essay on Classification, p. 182.)

† 'African Sketch Book,' vol. ii. p. 523.

‡ 'The Human Species,' p. 244.

§ We use this term as defined by J. S. Mill: "Nature means the sum of

and in a creature that had reached the stage of protection afforded by human society, and of aggression by human invention, were outside the ordinary action of natural selection, and became fixed and hereditary. The colour of mankind can in no sense come under the explanations of protective or aggressive resemblance, mimicry, warning or nuptial colouration, &c., and if there are physiological advantages appertaining to the different hues in connection with the climates in which these differently coloured races are found, these advantages are probably incidental to, or rather the effects of, a perfect acclimatization. Perhaps suggestion in this problem is too crude and too early; and, as Tylor cautiously observes, "the great races—black, brown, yellow, white—had already settled into their well-known characters before written record began, so that their formation is hidden far back in the præ-historic period"*; or, as Darwin more precisely writes, "we are far from knowing how long ago it was when man first diverged from the Catarhine stock; but it may have occurred at an epoch as remote as the Eocene period; for that the higher Apes had diverged from the lower Apes as early as the Upper Miocene period is shown by the existence of *Dryopithecus*."† We may well conclude that our earliest progenitors had a more or less hairy covering, but if we are ignorant on this very point, how much less should we speculate on the colour of the same.

There is considerable evidence to be obtained that surface geology induces assimilative colouration in plants as well as in animal life. Thus in the charming 'Letters of Rusticus,' and in connection with the locality of Godalming in Surrey, this passage occurs:—"The soil is a bright red sand, which extends from the chalky range of cold poverty-stricken downs crossing the country

all phenomena, together with the causes which produce them; including not only all that happens, but all that is capable of happening, the unused capabilities of causes being as much a part of the idea of Nature as those which take effect" ('Three Essays on Religion,' p. 5). There is also a purely literary or artistic idea of Nature, which sometimes becomes hysterical, and finds an amusing illustration in a sentence quoted by Max Nordau: "Nature is so indifferent, so unappreciative. Whenever I walk in the park here, I always feel that I am no more to her than the cattle that browse on the slope" ('Degeneration,' p. 319).

* 'Anthropology,' p. 85. † 'Descent of Man,' 2nd edit. p. 156.

from Reigate to Farnham. Between the chalk and the sand is an exceedingly narrow tract of blue clay, sometimes scarcely ten yards in width. These three distinct soils do not gradually intermingle, but are separated by the most abrupt transitions, and their effect on the produce where the three soils occur in the same field is very marked. . . . Wherever the sand bears the red tint of iron, the chief natural produce is furze; but this colour, as we proceed westwards, yields to a blue tint. The two colours stain the wool of the sheep which range the wastes, and the red and blue are very conspicuous in their fleeces, the blue being much preferred." * In Hampshire, Mr. Starkie Gardner states, "the heath is in some patches of a magenta colour where a crimson clay patch forms the soil." † Lord Walsingham's head keeper told Mr. R. Kearton that "stiff clay land on which pheasants feed produces dark-coloured eggs, and a light sandy soil pale-coloured ones"; and the writer remarks: "This contention he certainly supported by several instances which he brought under my notice, although other keepers to whom I have mentioned the circumstance have no faith in its accuracy." ‡ "In British Guiana some have gone so far as to say that they can tell when an auriferous district has been reached by the prevalence of certain kinds of birds and Monkeys. This can be easily understood when the close connection of the trees with the soil, and the fruit with the animals, is considered." § In the Magúngo country of Equatorial Africa, Emin Pasha speaks of "the red clayey ground," and describes the red blooming Canna as "being everywhere abundant." ‖ These observations could doubtless be multiplied if interest was awakened on the question, as on the "reddish argillaceous earth, called 'Pampean mud,'" which overspreads the Rio Plata region, ¶ or on the immense granite formation which forms one of the geological features of the State of Perak in the Malay Peninsula, of which "the prevailing colour is blue." ** The nature of the environment has

* 'Letters of Rusticus,' pp. 1–2. † 'Nature,' vol. xv. p. 230.
‡ 'With Nature and a Camera,' p. 166.
§ James Rodway, 'In the Guiana Forest,' p. 81.
‖ 'Emin Pasha in Central Africa,' p. 26.
¶ Orton, 'The Andes and the Amazon,' p. 283.
** Tenison-Woods, 'Nature,' vol. xxxi. p. 152.

also a distinct effect upon the structure of plants. Thus in the Mediterranean regions *Ranunculus ficaria*, as compared with the typical species growing in England, "bears finer and larger flowers and leaves, so that it is generally recognised as the variety *Calthæfolia*." *Caltha palustris* "has itself no recorded variety in low-lying situations." "When, however, this plant manages to get away from its habitual environment, and to reach 'mountainous places' (Hooker), it puts on characters which descriptive botanists have independently noticed and variously named as varietal or specific. It is commonly known as *Caltha minor*." "Many experiments have shown that if plants, or their seeds, be taken from lowlands and planted on alpine regions, all those that change their structures at once begin to assume more or less the same anatomical and morphological characters as the plants normally growing in highland regions."* Again, according to Kerner, a plant of the grass *Glyceria fluitans* "growing on damp soil on the edge of a stream over the water had linear *bluntly-pointed* leaves, whose sheaths were on the average 15 cm. long, the blades 23 cm. long and 8·5 mm. broad. After this plant had been submerged under rapidly-flowing water in the following year, leaves unfolded, which tapered gradually to a point, with a sheath having a mean length of 47 cm., and blades 73 cm. long, but only 5 mm. broad. The blades produced in running water were three times as long, and actually rather narrower than in the air."† According to Varigny, "Curtiss had seen in some places near the Potomac *Bidens cernua* acquire a height which is six times the common average height of this plant, and he has seen the same in *Oxalis stricta;* C. Lemaire states in D'Orbigny's 'Dictionary' that, while cultivated hemp grows no higher than a metre and a half in France, in Piedmont it attains three and four metres; and if Italian stock is planted in France it rapidly reverts to the small variety in the course of two or three years." "It is also well known that where mountain plants are transferred to the valleys and plains they lose the hairy covering which they generally possess, while valley plants transferred to the mountains acquire this same covering." "The common Dandelion (*Taraxacum dens leonis*) has in dry soil leaves which are much more

* Henslow, 'Natural Science,' vol. vi. pp. 386, 388, 389.

† Kerner and Oliver, 'Nat. Hist. Plants,' vol. ii. p. 502.

irregular and incised, while they are hardly dentate in marshy stations, when it is called *Taraxacum palustre*." * "Plants growing on chalky soils, when compared with those growing on richer soils, are often more thickly covered with down, which is usually of a white or grey colour. Their leaves are frequently of a bluish green tint, more deeply cut, and less veined, while their flowers tend to be larger and of a lighter tint. . . . Sea-salt has the general effect on many different kinds of plants of producing moist fleshy leaves and red tints." † The Rev. Hamlet Clark records a remark made to him by "one who evidently knew the subject":—"The quality of wine depends always and absolutely on the locality in which the vineyards are cultivated, *not* on the stock whence the young trees are derived. The same vine which in the South of France produces French wines will, if transplanted to the Cape, produce Cape, to Madeira, Madeira, to Teneriffe, Teneriffe wine." ‡ According to Allan Gordon Cameron, "The ground-tint, so to speak, among Old World Deer—genera *Cervulus* and *Cervus*—is from brown to black, but unmistakably dark; among New World Deer, on the other hand,—genus *Cariacus*,—it is a light stone colour, sometimes very light indeed. Before me, as I write, are the antlers of a British Stag and of an American Black-tailed Deer, which to a casual observer exhibit almost the difference in colour between black and white. It seems to me that a contrast of this kind, which is fairly constant in the respective species, cannot be ascribed either to the quality of the fraying post or to the constituents of the blood-stain on the antlers, but must be a specific character of the bone structure, which reacts differently to more or less similar external conditions. Variation in the colour of horns, both in Oxen and Antelopes, seems to point the same way." § Moseley was told that the Goats which are wild on the island of St. Vincent, one of the Cape Verde Islands, "have all attained a red colour resembling that of the rocks." ‖ As the Rev. H. A. Macpherson remarks, "the colour of Red Deer varies not only with the

* 'Experimental Evolution,' pp. 72, 91, 95.
† Romanes, 'Darwin, and after Darwin,' vol. ii. p. 207.
‡ 'Letters Home,' p. 90.
§ 'Field,' January 16th, 1897.
‖ 'Notes by a Naturalist on the "Challenger,"' p. 54.

summer and winter coat—for that is obvious—but also with particular districts."*

In the New Hebrides the soil of nearly all the islands consists of a "rich volcanic mould." Pigs, Fowls, and Dogs are said to have been brought into the islands within the last one hundred years, and Capt. Cook has the credit of having introduced the first two. The Fowls have gone wild in the bush, and have "become small and of bantam-like appearance, and are generally of a brownish colour, with all white tail feathers."† This is only approximate evidence; but more direct testimony is afforded by Mr. Lydekker, who states: "The rich red soil of Devonshire is tenanted by a breed of cattle readily distinguished by the deep red colour of their hair."‡ According to the same authority, in certain parts of America, the Falkland Islands, Australia, New Zealand, and other countries, the cattle introduced from Europe have run wild, and form vast herds. Those found in Texas and on the Argentine pampas have become of a nearly uniform dark brownish red colour; while in the Ladrone or Mariana Islands, in the Pacific Ocean, all the wild cattle are white with black ears."§ It would be interesting to know the prevalent surface colour of the soil at Porto Santo, an island near Madeira. To relate a well-known fact, in the year 1419 a few Rabbits born on board ship of a tame Spanish Rabbit were put on the island. The animals not only increased so enormously as to become a pest, but in the course of four hundred and fifty years have developed into a distinct variety or species, which is distinguished among other acquired peculiarities of structure and habits by a "peculiar colour."‖ Mr. Lydekker confirms this statement, and states that the descendants of these Rabbits "have now formed a breed distinguished by their small size, the reddish colour of the fur of the upper parts and the grey tints of that below. So different indeed are these Rabbits from the ordinary kind that the two kinds will not even breed together; and if the history of the Porto Santo race were not known, it would undoubtedly be re-

* 'Red Deer' (Fur and Feather Series), p. 43.

† Somerville, 'Journ. Anthrop. Instit.,' vol. xxiii. pp. 364, 390–1.

‡ 'Roy. Nat. Hist.,' vol. ii. p. 170.

§ *Ibid.* p. 172.

‖ Haeckel, 'History Creation,' Engl. transl. 4th edit., vol. i. p. 150.

garded as a distinct species."* In Queensland the Rabbit has apparently acquired poisonous qualities. Lumholtz relates:—"The next night we made our camp on an island, and the squatter at once went out to shoot Rabbits with his rifle. The Rabbits had been placed on this island a few years previously, and although there was no fresh water, excepting when it rained, still they throve very well, and had greatly increased in numbers. Strange to say, these Rabbits are said to be poisonous, doubtless on account of the food on which they are obliged to subsist. The squatter informed me that a year ago he had visited the island and shot some of these animals, which were roasted and eaten, but had made both him and his companions ill." † They vary also remarkably in colour. Prof. Strong states:—"I have seen more parti-coloured Rabbits in Australia than I have ever seen in Europe. Near Queenscliffe numerous instances occur, not merely of white and black Rabbits, which are common, but of Rabbits with beautifully striped skins." ‡ In Paraguay the domestic Cat has become one-fourth smaller, its body is slender, its hair short, shiny, thin, and pressed closely to the skin, especially on the tail, which is almost naked (Rengger).§

(To be continued.)

* 'Royal Nat. Hist.,' vol. iii. p. 200. In the face of this and other testimony it is somewhat startling to find Weismann stating no alteration has taken place: "The Rabbit which was brought by sailors to the Atlantic island of Porto Santo has bred abundantly, and remains unchanged in this locality" ('Essays upon Heredity,' &c., Engl. transl. 2nd edit.vol. i. p. 271).

† 'Among Cannibals,' p. 322.

‡ 'Zoologist,' 3rd series, vol. xviii. p. 406.

§ Eimer, 'Organic Evolution,' Engl. transl. p. 102.

THE AUTUMN SONG OF BIRDS.

By Charles A. Witchell.

The songs of birds are worth investigating; but before progress can be made in the knowledge of the why and wherefore of these songs, we must ascertain how and *when* they occur. The last particular is especially important. It is very well to attribute the songs of birds to an erotic origin; but that will hardly account for the Robin and Starling recommencing in July or the first few days of August. Nor will it account for autumnal songs which are preceded by a period of silence (*e.g.* the Chiffchaff), or which are followed by a silence, which is not the case with the Robin and Starling. The September songs of Willow Wren and Chiffchaff are so exceedingly few and far between, as compared with the spring songs, that they may very probably proceed from birds that did not breed in spring, or whose nests were destroyed.

My particular reason for calling attention to this theme is that my own observations seem to conflict with some other records. This may be due to the fact that I have always been "an early bird"; while other observers with less exacting avocations may be more of midday or evening observers. When articled and subsequently in a practice at Stroud, where most of my observations were made, I never loafed after birds during office hours, but was out on nearly half the fine mornings from 6 or 6.30 till 9 o'clock a.m.

In a paper on the autumn song of birds (Zool. 1894, p. 410) Mr. O. V. Aplin says that the Willow Wren (after being silent from mid-June) strikes up again about the second week in August. The words "strike up" are, however, also applied to the Robin and Starling in November or October. Mr. Aplin has assured me that the remark does not, in the case of the latter birds, mean commencing to sing, but the employment of a new style of song. As, however, in the same paper he has a special reference to the Starling as singing in October (why October,

when it begins early in August?), I can only regret that Mr. Aplin was here less careful than usual in expressing his meaning. Unfortunately for me, Mr. Aplin, while not in the least minding my attempting to correct him, found it impossible to believe that I had supposed him ignorant of the singing of the Robin and Starling early in August. But that is just what an ornithologist of repute might overlook. To take a similar instance: How many generations have observed the Swift! Yet, how many scientists will admit its night-flight as a fact? The mimicry of wild Lark and Thrush: how long has it been admitted? It may be denied that the latter mimics the Crow or Land Rail, for its pipe is not suited to coarse cries; but its general mimicry is bound to be admitted sooner or later.

The only previous letter I had received from Mr. Aplin described the wonderful mimicry of a bird which was carefully identified as a Sedge Warbler. But Mr. Warde Fowler told me that in the opinion of the listener the bird ultimately resolved itself into a Marsh Warbler.

Returning to autumn songs. I heard the Wren and Robin nearly every morning from July 7th to August 15th; but not once the Chiffchaff. That bird has a true autumn song, though only one or two here and there indulge in it.

As to the Willow Wren, I have made careful observations on every day but two from June 1st to August 19th. Those two days were cold and wet, so probably there was then nothing to observe. In June and July I observed at morning and evening. My opportunities were easy. In front of my cottage is a small meadow, flanked on two sides by a dense thicket, so I have only to open a window to hear the birds. In the back garden I am within hearing of two other thickets. I pass three others on my way to the railway station, which I reach by nine o'clock.

The Willow Wren has this interesting feature (due perhaps to pugnacity), that when one begins to sing, another will begin almost at the same moment; and when many are in song at the same spot, their successive descending songs make a sort of "chiming," very sweet to hear. I do not know any other bird with this habit. In May the chiming can be heard all day.

I am sending a copy of my notes to the Editor, and will here only summarize them.

The Willow Wrens sang every day but one in June, the 27th, which was wet and cold. From three to five or six were heard at the same time on every fine warm morning. On cold mornings only one or two could be heard.

The evening song (after seven) was abandoned early in July. July 13th was cold, and no Willow Wren sang; 14th, two, occasionally. From 15th to 24th two could generally be heard in the morning; sometimes one. On 25th (7 to 8 a.m.) four or five were singing, sometimes chiming. 26th to 28th, five or six could be heard. 29th and 30th, cold; one heard. Thence to August 14th from one to three or four could be heard, except on the 7th, which was wet. From 14th to 17th two could generally be heard. On 18th none. 19th, two occasionally. 23rd to 28th, none.

There was no doubt of the song when audible. When two or three were singing I heard about twelve phrases per minute (counted). If any were singing I never had to listen for a minute without hearing them.

But though this year the Willow Wrens were not silent in the latter half of June, I had previously formed the opinion that in some years they are so silent, although the species is otherwise our most persistent summer singer. Had I never risen before nine o'clock I should never have noticed the July singing. Since the middle of July it has been the sole Warbler in song.

I may say I have observed the July singing of this bird for many years. A particular incident fixes my memory of one occasion of the kind. More than twenty years ago, at Stroud, I was developing into what the Americans might appropriately term a "collector-fiend," and wished to "procure" a Willow Wren. It was on the 15th of July I went to a thicket where these birds swarmed, and I shot two with a catapult, but found them in heavy moult. Another came along; he sang beautifully, and I shot him. He fell, but rose again and sat on a twig, with one thigh shattered and hanging loose. But he sang his little strain. Another came and attacked him, and he flew a few yards, while I crept after like a murderer. He sang again, his wings pulsating with the notes. I shot him dead. His death probably saved the lives of many birds, for it made me give up the procuring of specimens. But it also made me remember that the Willow Wren sings in mid-July.

NOTES AND QUERIES.

MAMMALIA.

RODENTIA.

Conduct of a Rabbit when pursued by Dog.—One day in July last, when my daughter was walking in my garden here, a little Dog which was with her put up a Rabbit (*Lepus cuniculus*) from one of the flower-beds, which was chased for a short distance by the Dog, when it squatted in the grass, the Dog running round it, wagging its tail and barking. After a few moments it started off again, but, after running about one hundred yards, again squatted, the Dog running round and barking at it as before; when the Rabbit, which was quite full-grown, allowed my daughter to pick it up, and she brought it to me. It seemed as if dazed, and made no attempt to escape.—Wm. Borrer (Cowfold, Horsham, Sussex).

[There are many records, and from all parts of the world, of wild animals taking refuge with man when pursued by their enemies.—Ed.]

AVES.

The So-called St. Kilda Wren.—In a review of one of Mr. C. Dixon's publications—I fancy the title had something to do with vanishing birds—in the 'Spectator' of July 30th ult., the writer refers to Mr. C. Dixon as the discoverer of the St. Kilda Wren (*Troglodytes hirtensis*). Possibly some reader of 'The Zoologist' will correct me if I am in the wrong, though I have certainly long been under the impression that the St. Kilda Wren was "discovered" years before Mr. C. Dixon ever set foot on the island, and that every well-informed ornithologist was aware of—well, the fact. I gather from my researches that exactly two hundred years ago, in 1698, the possession of a Wren by St. Kilda was recorded by Martin, in his 'Voyage to St. Kilda'; that in Macaulay's 'History of St. Kilda,' 1764, the species is again mentioned; that in 1831 Atkinson paid a visit to the island and identified the little bird; while, in June, 1883, Barrington likewise came across it on some half-dozen occasions, though he failed to secure a specimen. As Mr. C. Dixon's journey to St. Kilda was not undertaken till 1884, I fail to appreciate the validity of the claim put forward by the late Henry Seebohm on behalf of his understudy, and repeated by an anonymous reviewer in the 'Spectator' only so recently as last month

How far *Troglodytes hirtensis*, the Wren found on St. Kilda, is justified in being advanced to specific rank may be open to argument, though the best authorities appear to look with disfavour on such an advancement; but, touching rightful pretensions to whatsoever *éclat* there may be associated with the discovery and re-discovery of the little bird on the island, there is surely no room for two opinions. — H. S. DAVENPORT (Melton Mowbray).

Scoters in Summer.—Early on the morning of June 7th, when a few miles off Southerness, hundreds of Scoters were flying round the yacht. Four Velvet Scoters (*Œdemia fusca*) were detected, and no doubt there were others. In July, when sailing over the same spot, I observed the birds again, and I have often seen numbers of them in summer in the same locality. On the evening of June 13th, whilst fishing in Wigton Bay, a pair of Red-throated Divers (*Colymbus septentrionalis*) were seen. The birds were in full summer plumage, being apparently paired, and from their manners, had I been a little further north, I should have had no doubt as to the existence of a nest not far off. I visited several old nesting places of the Chough on the Kirkcudbrightshire coast, but not a bird of the species was to be seen, and I fear they have gone, never to return. Talking to an old fisherman, who was a close observer of birds, I gathered that fifty or sixty years ago they were common in several localities. Latterly they seem to have been driven away by the Jackdaws, which have increased in numbers.—J. J. ARMISTEAD (Solway Fishery, Dumfries).

Ivory Gull on the Solway.—On Aug. 3rd, when riding at anchor in the Solway Firth, I had the gratification of observing one of these rare birds (*Pagophila eburnea*) from my yacht. We had just had tea, and the scraps had been thrown overboard for the birds, which soon came round the yacht in considerable numbers. They were a mixed lot, by far the largest proportion being of the Black-headed species, interspersed with a few Common Gulls, and also some representatives of the Herring and Lesser Black-backed kinds. One bird of a creamy-white colour attracted my attention, and as it came round for the third time, I distinctly saw that it had black feet; its bill was dusky, as far as I could see. Something suddenly alarmed the birds, and they retired to a distance and settled on the water, and I had not another good opportunity of observing the stranger that day. Next morning, however, on turning out early to weigh anchor, I saw it again. This time it was feeding on the ooze, in company with some Black-headed Gulls, about one hundred and fifty yards away. It bore a striking resemblance to a white Pigeon, and a novice would have had the impression that one of these birds was feeding amongst the Gulls. — J. J. ARMISTEAD (Solway Fishery, Dumfries).

Birdsnesting in August.—For the last two years I have noted in 'The Zoologist' a list of nests with eggs and young found on Bank Holiday in Cambridgeshire. This year I was in the same district, but searched mostly in a different direction, and the following were my discoveries:—One nest of Bullfinch, with one naked young and four eggs hatching; three nests of Thrush, with eggs stale, apparently deserted; one nest of Turtle Dove, with two eggs; one nest of Wood Pigeon, with two eggs; two nests of Meadow Pipits, with four and five eggs respectively, all apparently fresh; two nests of common Whitethroat, with young; eight nests of Yellowhammer, with eggs, mostly fresh; two ditto, with young; one nest of Tree Sparrow, with two eggs deserted; two nests of Linnet, with eggs; one ditto, with young; six nests of Greenfinch, with eggs, half of them fresh; two ditto, with young; one nest of Hedgesparrow, with one egg in hatched-out nest; two nests of Blackbird, with eggs deserted; one of these contained one handsome egg of deep spotless blue, with a rich zone of brown at the large end. This does not include new nests of Wood Pigeon, House Sparrow, Swallow, and House Martin, which I did not examine.—Robert H. Read (7, South Parade, Bedford Park, W.).

Coition of Birds in the Air.—Readers of 'The Zoologist' have doubtless been interested in some remarks that have lately appeared on this subject in the pages of that Journal. I therefore send you a short account of a personal observation. Whilst passing along one of the roads skirting Clifton Downs, about the middle of June last, I noticed some six or eight pairs of House Martins (*Hirundo urbica*) engaged in collecting mud from the road. Suddenly a pair alighted within three or four yards of me, where I could see them quite plainly. Immediately they dropped into the road the male bird jumped on the back of the female, and appeared to attempt copulation. In an instant, however, the hen slipped from under him, and flew toward me, pursued by the cock bird, uttering loud cries. When quite close, I distinctly saw the male bird (whilst both were in the air) resume his position on the back of the female, and complete the act of copulation. They did not appear to take the least notice of my presence. —W. Barrett Roué (Clifton, Bristol).

Parasites in Birds.—A most interesting although serious epidemic in the form of Tape and Round Worms infests every Thrush and Blackbird in this immediate neighbourhood. All through last year it was prevalent, and at present seems to be on the increase. During the last two months I have examined some forty to fifty examples of *Turdus musicus* and *T. merula*, also two of *T. viscivorus*, that have been netted or shot from the fruit. In every case the intestine, and in a few the entire length of the alimentary canal, was full of a small Tapeworm, of about an inch in length,

intermixed with a few Round Worms. I cannot understand why every bird should be thus infested. One young Blackbird, caught by my dog, which could only have been out of the nest some few hours, was equally full. There are great numbers of these birds about this year, and at present they are feeding out in the fields. This seems to be most injurious, as dogs, horses, and cattle are thus exposed to the parasites. I enclose specimens taken from various Blackbirds and Thrushes, and should be very interested to know to which family of the *Tæniæ* they belong.* I have examined a few Starlings and small birds, but in no instance have found them infested. If any readers of 'The Zoologist' have come across a similar occurrence I should be glad to hear of it, also if there is any means of reducing it.—J. L. Newman (Mill Hill, Middlesex).

* We have not, as yet, had an opportunity of having the specimens identified.—Ed.